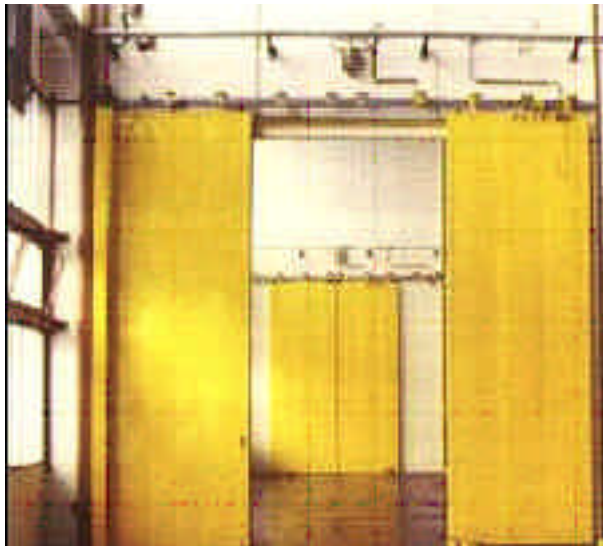


Energy Efficient Refrigeration with Zero Ozone Depletion



Transferable Solution

Project Summary

Project Activities

Project Benefits

Lessons Learned

Contact Information

Project Title: Development of Low and Medium Temperature Cooling Rooms with Zero Ozone Depletion Potential and no mission of Greenhouse Gases

Leader: Institute for Refrigeration and Air Conditioning (IRAC) JSC, Bulgaria

Partner: Femtechnika, Hodmezovasarhely, Hungary

Location: Sofia, Bulgaria

Project Duration: January 2000 – November 2000

EcoLinks Project Investment: Total EcoLinks Project Investment: \$87,559;
EcoLinks Grant Support: \$45,000; Project Partner Cost Share Contribution: \$42,559.

Best Practice: Transferable Solution

This project is a Best Practice because it allowed for the development, testing, and marketing of cooling systems that are more efficient and use an alternative refrigeration substance, R404A, with zero ozone depleting potential. R404A is an innovative product that can be substituted as a refrigerant agent in the manufacturing of any cooling room. The Institute and Femtechnika have initiated marketing this item and are making it available throughout Eastern and Central Europe. The technology and expertise for developing the cooling rooms designed and tested in this project is easily transferable.

Project Summary

Most refrigeration units in Bulgaria and throughout Eastern and Central Europe involve equipment that is energy intensive and uses ozone-depleting gases such as chlorofluorocarbons (CFCs) and hydrochloroflourocarbons (HCFCs). Inefficient use of energy unnecessarily pollutes the environment and puts pressure on valuable resources, some of which are not renewable. Technology that minimizes energy use and avoids the use of CFCs and HCFCs is needed.

While the market for more efficient and environmentally friendly products is expanding, the technology and market for refrigeration units that meet these criteria have not been fully explored. Prior to the implementation of this project, the Institute of Refrigeration and Air-Conditioning J.S., a Bulgarian firm, did not have sufficient resources and expertise to develop efficient, environmentally friendly refrigeration units. With the support of an EcoLinks Grant, the Institute of Refrigeration and Air-Conditioning J.S., in collaboration with Femtehnika of Hungary, prepared the design and prototype for cooling rooms that require less energy than their Bulgarian counterparts and zero ozone-depleting refrigeration agents.

The Institute for Refrigeration and Air Conditioning (IRAC) JSC, Bulgaria, engages in research, design, manufacturing, engineering, testing and trade in the field of refrigeration and air-conditioning. The company is a successful actor in the Bulgarian market for refrigeration and air-conditioning and strives toward increasing its presence in the international market. In response to market trends demanding more efficient and environmentally friendly products, the company became interested in the design and production of quality, industrial cold rooms that use less energy and operate without ozone-depleting agents.

The purpose of this project was to design efficient, environmentally sensitive, low and medium temperature cooling rooms. The first stage of the project consisted of putting together the cold room design that would meet the goals of low energy use and minimal environmental impact. Refrigerant R404A was identified as an effective substance to be used in the newly designed cooling rooms. The cooling rooms were then constructed and tested. Measures to market the new technology in several countries in Eastern and Central Europe were taken. The new technology was marketed both in Bulgaria and Hungary via leaflets (over 5000 were distributed), workshops (4) and international trade fairs.

R404A is a mixture of the following substances: 44 % of R125, 52 % of R 143a, and 4 % of R134a. None of these components contains chlorine atoms, therefore, the Ozone Depletion Potential (ODP) of the new refrigerant is zero. The cooling technology developed through this project uses 10-20 % less energy than the current Bulgarian alternative equipment, does not contribute to ozone depletion, and helps to reduce the impact on global climate change.

Project Activities

The purpose of this project was to design and construct two types of efficient and environmentally sensitive cooling rooms and initiate corresponding marketing efforts. To accomplish this, four main activities were conducted:

1. Researched and designed cooling rooms

Action: Working plans for the construction of the cooling rooms and the doors were made. Different door types, insulation, refrigeration schemes, machines, equipment, and refrigeration automation mechanisms were reviewed to select the optimal alternatives for minimizing energy-loss. The building of the cooling rooms was initiated.

Product(s): A design for efficient and environmentally friendly cooling rooms.

2. Constructed cooling rooms

Action: Three cooling rooms (2 x 35 m³, 1 x 225 m³) were erected at the Institute of Refrigeration and Air-Conditioning. This included the development and installation of insulation, condensing units and refrigerant, air cooler, refrigeration automation, and electrical devices for control and operation of the unit.

Product(s): Three cooling room prototypes (two cooling rooms of capacity 35 m³ and one of capacity 225 m³).

3. Tested prototypes

Action: Tests were conducted to 1) assure that the design and operation of the products complied with Bulgarian standards, and 2) assess technical performances such as electrosafety, reliability, and acoustics.

Product(s): Testing protocol.

4. Developed and implemented marketing strategy

Action: A marketing strategy for the cooling rooms was developed and initiated. The new products were promoted in Bulgaria, Macedonia and Albania. International exhibits of the equipment were displayed and part suppliers were identified. Seminars with potential clients were organized and the cooling rooms were also presented at an annual fair in Bulgaria. Marketing brochures were created.

Product(s): 1) An agreement for new cooling rooms to be included in the marketing strategy of the two project partner companies for Bulgaria, Hungary, and other countries in the region 2) International exhibits of the equipment 3) Part suppliers 4) Seminars with potential clients 5) Fair presentation of cooling rooms 6) Marketing brochures.

Project Benefits

This project is linked to several benefits. The capacity to make refrigeration systems in Eastern and Central Europe that reduce environmental impacts and save money has been strengthened. A new market has been opened. By increasing the energy efficiency of refrigeration systems, there is reduced pressure on limited non-renewable energy resources, less pollution, and lower appliance operating costs.

Capacity Building Benefits

This project opens up a new market for environmentally friendly, economically beneficial refrigeration systems. The production and sale of these systems makes refrigeration companies in Eastern and Central Europe more competitive and therefore helps to build the economic capacity of the region. Additionally, expertise and awareness regarding low impact refrigeration systems have been developed.

Environmental Benefits

This project establishes cooling systems that use less energy and do not require ozone-depleting agents. This reduces the consumption of energy resources and pollution associated with electricity production. It lowers the impact on the protective ozone layer by providing an alternative refrigeration substance to CFCs and HCFCs that cause ozone depletion. Ozone depletion contributes to global warming and increased human exposure to harmful rays associated with increased risk of skin cancer and other health problems.

During operation, the energy consumption of the prototype cooling rooms is 10-20% lower than similar cooling rooms currently used in Bulgaria.

Table 1: Comparison of unit energy consumption for new and old cooling rooms

Capacity of cooling chamber	Unit energy consumption [W/m ³]		
	Old design	New design	%
Small (35 m ³)	20-25	18	14
Large (200 m ³)	16-18	14	10

An especially notable environmental benefit introduced by this project is that it alleviates ozone depletion through the introduction of R404A, a refrigerant that has zero potential for ozone depletion. Other cooling agents currently in use have an ozone depletion potential that varies from 0.28 to 1 (whereby 1= highest ozone depleting potential).

Economic Benefits

The economic benefits derived directly from this project include opening a new market and increasing company competition for environmentally friendly products. The long-term economic benefits from this project are the creation of new jobs and the generation of energy cost savings for consumers. The economic benefits are summarized as follows:

- By offering environmentally friendly cold rooms and doors for cold-storage rooms, Femtechnika will expand its distribution net in the Balkans and increase its exports. Starting from the year 2000 Femtechnika sold altogether 37 new freezer doors and sliding gates of different types.
- New job opportunities are created in companies applying the new technology developed through the project.
- Those purchasing the cooling rooms will reduce their energy costs by approximately 5 % of total energy costs for refrigeration.

Lessons Learned

Certain lessons can be taken from this project that provide additional insights for future applications of the tools and techniques established by this Best Practice. They include:

- Materials should be ordered in advance so that their arrival does not delay construction time. Also, some manufacturers of the necessary parts of the cooling rooms are closed in the summer.
- Prototypes are useful for testing design plans to see if the product matches expectations, developing testing protocol for the new product, and for marketing.
- Information regarding new technology should be gathered in the early stages of the project to avoid delays in the execution of the project.

Contact Information

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